Some Say the Rockets' Red Glare Is Eating Away at the Ozone Layer

By WILLIAM J. BROAD

HUNDREDS of rockets roar to life every year, some trailing clouds of toxic exhaust that chew up the life-protecting ozone shield high in the atmosphere. How much ozone is destroyed in this fashion is unknown, and may be small compared with indstrial pollution. But it is large enough to have worried some scientific and public-interest groups.

For their part, rocket manufacturers and users contend that the problem is insignificant and that the cost of correcting it would far outweigh the possible benefits.

The ozone is harmed by solid-fuel rockets, whose exhausts often contain large amounts of hydrochloric acid. Chlorine, when released from the acid, rapidly breaks down ozone molecules, letting more of the sun's ultraviolet light penetrate the atmosphere and raising the risk of skin cancer. In contrast, the exhaust from liquid-fuel rockets is typically composed of water and carbon dioxide.

No one knows how many solid-fuel rockets are fired each year, or how many fly high enough to destroy ozone. The United States Space Command, based in Colorado Springs, Colo., which keeps tabs on global rocket launchings of all types, estimates that 500 to 600 rockets were fired every year during the 1980's, with the number peaking in 1989 at 1,500. These firings ranged from space shuttles and large American rockets to relatively small Scud missiles, which are liquid fueled.

Despite the unknowns, some scientists have concluded that the ozone damage, though now perhaps slight, is worrisome because of the trend to increasing use of solid-fuel rockets around the world. In March 1990, a panel of the National Research Council of the National Academy of Sciences, which advises the Federal Government, called for a switch to liquid propellants, saying this would eliminate rocket-born "pollution of the atmosphere."

In June 1990, the signatories to the Montreal Protocol, which seeks to ban substances that deplete ozone, directed the group's scientific panel

> The shuttle is the main focus of debate because of its huge solid-fuel boosters.

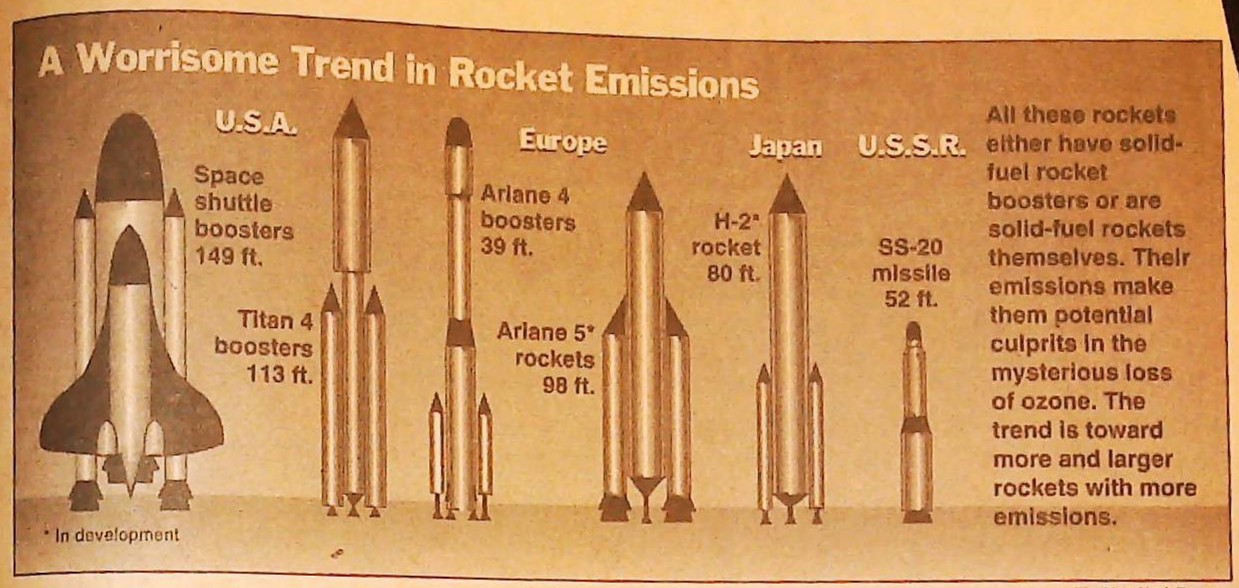
cant part of the problem," said Allan J. McDonald, vice president for space operations of the Thiokol Corporation in Brigham City, Utah, which makes solid-fuel rockets. Among the general public, he added, "there's an overreaction leading toward hysteria."

Switching to new fuels, Mr. McDonald said, would cost billions. "It would be a waste," he said. "We ought to spend that money cleaning up the CFC problem." CFC's, or chlorofluorocarbons, are industrial chemicals that constitute the chief cause of ozone destruction.

The main focus of the rocket debate is the shuttle, whose 149-foot twin boosters are the largest solid-fuel rockets in the world. The National Aeronautics and Space Administration estimates that each shuttle flight injects some 75 tons of chlorine into the stratosphere, the ozone-rich layer a dozen or so miles above the earth.

A different type of large booster helps power the Titan 4, this country's largest unmanned rocket. Its twin boosters are 113 feet tall.

Dr. Michael J. Prather, an atmospheric scientist at NASA's Goddard Institute in New York City, and his colleagues have calculated that the lofting of nine shuttles and six Titan 4's every year would add a mere 0.3 percent to the annual burden of stratospheric chlorine, which in turn would destroy far less than 1 percent of the ozone there.


A Worrisome Trend in Rocket Emissions
U.S.A.
Space shuttle boosters 149 ft.
Titan 4 boosters 113 ft.
Europe
Ariane 4 boosters 39 ft.
Ariane 5* rockets 98 ft.
Japan
H-2* rocket 80 ft.
U.S.S.R.
SS-20 missile 52 ft.
All these rockets either have solid-fuel rocket boosters or are solid-fuel rockets themselves. Their emissions make them potential culprits in the mysterious loss of ozone. The trend is toward more and larger rockets with more emissions.
* In development

The New York Times

"As a point source of pollution, the shuttle is clearly large," Dr. Prather said in an interview. "But compared to any other industry — refrigeration, foam blowing, solvents — it's small."

Shuttle's Benefits Cited

Nonetheless, some groups have attacked the shuttle as a serious environmental hazard, and the most caustic criticism has come from the Soviets. Aleksandr I. Dunayev, head of the Soviet space agency, Glavkosmos, was quoted in a 1989 Russian publication, Literaturnaya Gazeta, as saying, "About 300 launches of the shuttle each year would be a catastrophe and the ozone would be completely destroyed."

Western experts note that the Soviets are struggling to market their own rockets, which use liquid fuel more frequently than do those in the West.

An American group known as the Military Toxics Network, based in Seattle, says in a report entitled "No Free Launch" that each firing of the American shuttle or Titan 4 destroys more ozone "than the annual ground-level emissions of chlorofluorocarbons from most individual industrial plants."

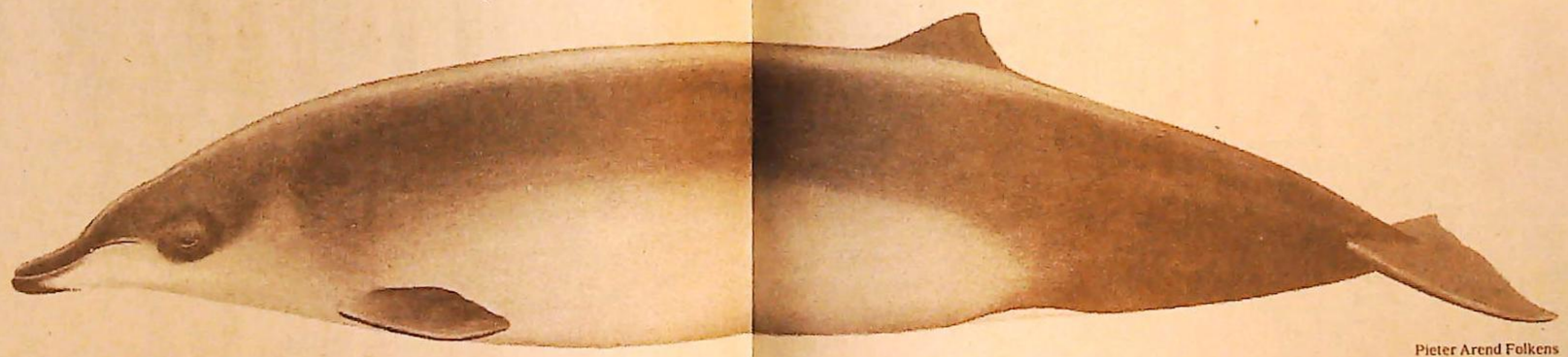
Dr. Prather of NASA agreed, but said the shuttle's minor environmental costs had to be weighed against its great scientific benefits. For instance, in September the shuttle Discovery is to loft the Upper Atmosphere Research Satellite, a 7-ton, 32-foot spacecraft that will help scientists better fathom global climate shifts and ozone destruction.

Mr. Aftergood of the Federation of American Scientists cautioned that the environmental "costs" of global rocketry were far from clear because of uncertainty over the actual number of solid-fuel rockets fired every year and doubts over the chemistry of ozone destruction. He noted that the Environmental Protection Agency recently reported that the measured ozone loss at the latitudes of the United States was 4.5 to 5 percent in the last decade, more than twice what scientists had previously thought.

"That means the models are wrong," Mr. Aftergood said. "A certain amount of humility is warranted."

Mr. McDonald of Thiokol said that about a dozen new solid-rocket fuels

New Species of Whale Is Discovered in Pacific



Pieter Arend Folkens

Artist's reconstruction of the beaked whale Mesoplodon peruvianus, based on six of the dead specimens and clues from other known species.

AN elusive gray creature that looks more like a dolphin than Moby Dick has been identified as the first new species of whale to be discovered in 28 years.

The newly described species, found in the Pacific Ocean off Peru, is the smallest member of a group called beaked whales. The adult male is about 12 feet long.

Dr. James G. Mead of the Smithsonian Institution, working with Julio C. Reyes and Koen Van Waerebeek of the Peruvian Center for Cetacean Studies, identified the species from carcasses that got caught in fishing nets or that washed ashore. The species has been named Mesoplodon peruvianus, which means "armed with a tooth in the middle of the jaw."

M. peruvianus is distinguished from other species of Mesoplodon by the size and position of its teeth, its relatively tiny cranium and its overall small size.

Most of the little that is known about Mesoplodons and the larger

tice for so long is a mystery. The scientists suggest that members of this species primarily live far from shore, keeping to themselves and avoiding ships.

"I think the sudden appearance of this species represents a movement of the population nearer to shore

to assess damage from rockets. That report is due in 1992.

Some See Hysteria

"It's appropriate to begin a transition now to cleaner propellants," said Steven Aftergood, a specialist on ozone depletion with the Federation of American Scientists, a private group based in Washington. "There's enough evidence of the danger."

But rocket makers and users disagree. "We're a very small, insignifi-

dolphin-like snout. They are seen so rarely that it took scientists 15 years to find enough specimens to feel confident that they were members of a previously unknown species.

Like other beaked whales, the newly described species, Mesoplodon peruvianus, has an elongated jaw, few teeth and apparently feeds on squid. The species appears to be uniformly gray on top, shading to lighter gray on the underbelly. At birth, the whale is about 5 feet long, and an

last 15 years. They described their finding earlier this year in Marine Mammal Science, a journal of the Society for Marine Mammology.

Two sightings of living whales of this species have been reported, but not confirmed, Dr. Mead said. The whale's range and population are unknown, but specimens recently found along the Mexican coast may belong to this species, he said.

First Clue in 1976

Just how a type of whale, even a relatively small one, could escape no-

where they occasionally get caught up in fisheries and where they may wash up on the beach when they die," Dr. Mead said.

The first clue that an undescribed species of whale might be cruising the Pacific came in 1976 when Dr. Mead found a partial cranium and vertebra in San Andes, Peru.

Remains from nine additional whales were found from 1985 to 1989 on the central and southern Peruvian coast. Taken together, the specimens provide persuasive evidence of a distinct species of the genus

family of toothed-whales called Ziphiidae has been learned from stranded carcasses that have washed ashore, Dr. Mead said. M. peruvianus is the 13th species of Mesoplodon to be identified, as well as the smallest.

Dr. Mead said that other species of whale, yet to be described, are probably prowling remote parts of the ocean. In 1987, scientists described sightings in the eastern tropical Pacific of a larger, distinctively colored whale that could be another new species of Mesoplodon.

were under investigation in the industry but that each had drawbacks. Some were less powerful, some dangerously explosive and some difficult to handle. "We have alternatives," he said, "but the amount of money to develop them isn't worth the impact it's going to have."

Mr. Aftergood disagreed, saying the cleanliness of fuels "ought to be an important factor in the selection of the next generation of rockets," adding, "It's just a matter of being environmentally responsible."